PATENT ABSTRACTS OF JAPAN

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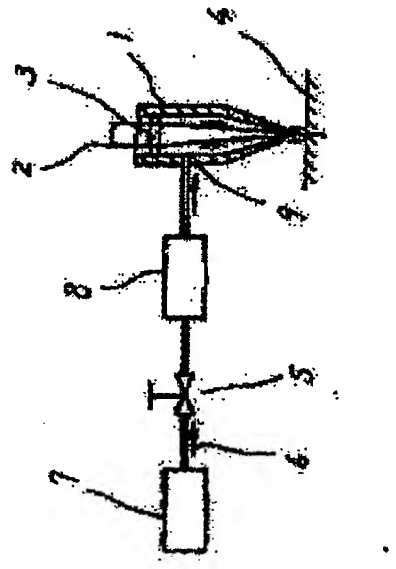
(54) LASER CUTTING METHOD

(57) Abstract:

PURPOSE: To reduce thermally influenced layer at the cutting part in cutting a plastics material with a laser beam by preliminarily cooling auxiliary gas that is sprayed to the cutting part into low temperature.

CONSTITUTION: A work 4 made of plastics is cut by a working head that irradiates a laser beam 2 converged by a condenser 3. At this time, compressed gas 7 of auxiliary gas such as air, argon, nitrogen etc. is cooled by a low temperature generator 8 and supplied from an inlet 9 of the working head 1 as low temperature auxiliary gas. The periphery of the cutting part of work 4 is cooled by the gas, and contaminations such as evaporation gas, molten substance etc. generated at the time of cutting are blown off and removed. The periphery of cutting part of the work 4 is cooled by low temperature auxiliary gas and the thermally influenced layer is reduced.



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⑭レーザ切断法

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明　細　書

発明の名称　レーザ切断法

特許請求の範囲

1．レーザを用いてプラスチック材を切断する方法において、補助ガスを低温発生器で冷却し、その冷却された補助ガスが切断部近傍に噴射することを特徴とするレーザ切断法。

発明の詳細な説明

本発明は、レーザでプラスチック材を切断する方法に係り、特に加工面の熱影響層を軽減するためのレーザ切断法に関する。非金属材料は、レーザビーム加工時の熱の影響を受け易い材質であるため、加工中の溶融物や蒸発ガスの付着を防ぐ必要がある。一般に、レーザ発生装置から取り出されたレーザビームは、ミラーによつて偏向されたのち、収束レンズによつて被加工物表面に集光され、高密度エネルギ源により瞬時に被加工物が溶融される。これらの溶融物は、補助ガスによつて被加工物下方に吹き飛ばし、溶融、除去の繰返しにより加工が進行する。

(1)

従来のレーザ切断法は、第1図に示すように、レーザビームにより溶融された加工溶融物を、高圧ボンベからの圧縮ガスあるいは、圧縮空気といつた圧縮気体を直接吹きつける方法が採られていた。しかしながら、非金属材料のように熱影響を受け易い材料を加工する場合は、加工面の熱影響層を軽減するため、低圧の補助ガスで、切断部近傍及び切断溶融物を急冷除去する必要がある。従来の補助ガスを直接吹き付ける切断法では、レンズの劣化、破損などが懸念され流速（補助ガス圧）にも制限があるところから、切断部近傍の冷却能力も流速に相対する程度にしか制御できず、熱影響層の軽減にもおのづと限界があつた。

本発明の目的は、レーザビーム加工時に、被加工物切断部近傍の急冷と加工溶融物や蒸発ガスなどの汚染物を、瞬時に除去することにより、加工面の熱影響層の軽減を図るためのレーザ切断法を提供することにある。

本発明は、プラスチック切断用補助ガス（アルゴン、窒素、空気）を、低温発生器により冷却し、

(2)

冷却された補助ガスを、被加工物近傍に吹き付けるようにした事である。この結果、従来のレーザ切断法に比べ補助ガスによる冷却効率を高め、熱影響層を軽減できる利点がある。

以下実施例によつて、本発明を詳細に説明する。第2図は、炭酸ガスレーザを用いた、切断加工における一実施例を示す。図は、圧縮気体7を、圧力調整弁5により加圧制御後、低温発生器8により冷却する。この低温圧縮気体は、補助ガス入口部9から加工ヘッド1の内部を経て、レーザ切断部近傍に噴射される。その時の加工条件は次の通りで、熱影響の少ない良好な切断ができた。

被加工物：板厚5㎜の塩化ビニール系樹脂
ビーム出力：400W
補助ガス：圧縮空気（Max. 6Kg/cm²）
補助ガス圧：5Kg/cm²
補助ガス温度：－11℃
切断速度：2m/min
レンズの焦点距離：254㎜
低温発生器：サンワエンタープライズ製形式

(3)

第3図に応用例を示す。圧縮気体7は、低温発生器8で(イ)，(ロ)に分離され、レンズの保護用として加工ヘッド1の内部へ、被加工物4の急冷および蒸発ガス、加工溶融物の除去用として切断部近傍にそれぞれ噴射される。

本発明によれば、補助ガスの低温噴射が可能となり、加工面の熱影響層を軽減できる効果がある。

図面の簡単な説明

第1図は従来方法の説明図、第2図は本発明の実施例説明図、第3図は応用例説明図を示す。

1…加工ヘッド、2…レーザビーム、3…収束レンズ、4…被加工物、5…圧力調整弁、6…補助ガス経路、7…圧縮気体、8…低温発生器、9…補助ガス入口部。

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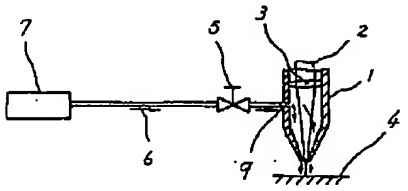
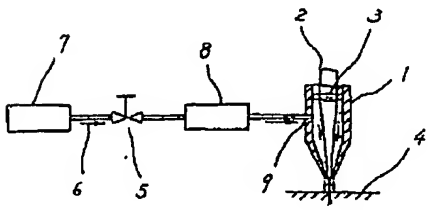
(4)

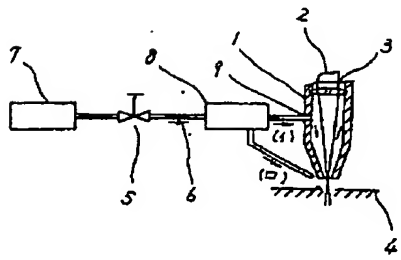
第1図



第2図



第3図



(aid-open patent application 57-118882 (1982.7.23)

[Title of the Invention] Laser cutting method

[What is claimed is]

[Claim 1]

A laser cutting method comprising:

a step of cooling an assist gas by way of a low temperature generator; and

a step of spraying the cooled assist gas in the vicinity of a cut spot.

[Detailed description of the Invention]

[0001]

The present invention relates generally to a method of cutting a plastic material by a laser beam and relates specifically to a laser cutting method for reducing a heat affected zone of a cut-processed surface. As the non-ferrous metals are susceptible to the heat affect upon laser beam process, the adhesion of the molten material, and the vapor generated when the laser beam is directed need to be avoided. Generally, after the laser beam generated from the laser beam generator is deflected by the mirror, the laser beam is caused to be focalized on to the surface of the workpiece to be laser-cut by the condenser lens, and the workpiece is instantly molten by the high density energy source. Such the molten materials are blown toward a lower part of the workpiece by the assist gas, and the laser cutting process is advanced by repeating melting and elimination.

The conventional laser cutting method, as shown in Fig. 1, employs the method of spraying the compressed gas like the compressed gas or compressed air from the high pressure container directly to the workpiece molten by the laser beam. However, when the material susceptible to the heat affect like the non-ferrous metals is laser-cut, for reducing the heat affected zone of the machined surface, the area in proximity to the cut edge and the molten cut spot need to be quickly cooled and eliminated by the low temperature assist gas. In the conventional laser cutting method of spraying the assist gas directly, there are concerns about the degradation and/or damage

of the lens, etc., and the conventional method has the restraint on the flow velocity (assist gas pressure), so the capability of cooling the area in proximity to the cut edged is controllable only up to the extent relative to the flow velocity, so that the reduction of the heat affect has its own limitation.

The present invention aims at providing a laser cutting method able to reduce the heat affected zone of the cut-processed surface by quickly cooling the area in proximity to the cut spot of the workpiece to be laser-cut, and instantly eliminating contaminations such as the processed melting material, the vapours, etc. upon the laser beam process.

The present invention is configured so as to cool the assist gas (Argon, Nitrogen, air) for cutting the plastic by way of the low temperature generator, and spray the cooled assist gas onto the area in proximity to the workpiece to be laser-cut. As the result of this, in comparison with the conventional laser cutting method, there are advantages in that cooling efficiency is enhanced by the cooled assist gas, and thus the heat affected zone can be reduced.

The present invention will be detailed below referring to preferred example embodiments.

Fig. 2 shows one example in cutting machining using a carbon dioxide gas laser. As shown in Fig. 2, compressed gas 7 is cooled by low temperature generator 8 after the compressed gas is pressure-controlled by pressure adjustment valve 5. This low temperature compressed gas is sprayed onto the area in proximity to the laser cutting spot through process head 1 from assist gas entrance section 9. Process conditions at this moment are as below, and excellent cutting can be performed with the reduced heat affect.

Workpiece to be laser-cut: Polyvinyl chloride resin with a thickness of 5 mm

Laser beam output: 400 W

Assist gas: compressed air (M^{ax}. 6Kg/cm^2)

Assist gas temperature: -11 ℃

Cutting speed: 2m/mm

Focal length of the lens: 254 mm

Low temperature generator: Sanwa Enterprise V-175-2088

Fig. 3 shows an applied example. Compressed gas 7 is split into (イ) and (ロ)by low temperature generator 8, and for protecting the lens, one of compressed gas 7 is sprayed onto an interior of process head 1, and for cooling the workpiece to be laser-cut 4 quickly and also for instantly eliminating the vapors as well as the processed melting materials, another thereof is sprayed onto the area in proximity to the cut spot, respectively.

According to the present invention, the spaying of the assist gas at the low temperature is possible, so that the present invention has an effect that the heat affected zone of the laser-cut processed surface can be reduced.

[Brief description of drawings]

Fig. 1 is an explanatory diagram of the conventional method.

Fig. 2 is a diagram explaining the example embodiment of the present invention.

Fig. 3 shows a diagram explaining the applied example embodiment.

1 MACHINING HEAD
2 LASER BEAM
3 CONDENSER LENS
4 WORKPIECE TO BE MACHININGED
5 PRESSURE ASDJUSTMENT VALVE
6 ASSIST GAS FLOW
7 COMPRESSED GAS
8 LOW TEMPERATURE GENERATOR
9 ASSIST GAS ENTRANCE SECTION